METAL CASTING

Project Fact Sheet

RAPID HEAT TREATMENT OF CAST ALUMINUM COMPONENTS

AUTOMATED IN-LINE FLUIDIZED BED ALUMINUM HEAT TREATMENT SYSTEM IMPROVES EFFICIENCY AND REDUCES POLLUTION

Technomics LLC, in conjunction with the U.S. Department of Energy's NICE³ Program and the Minnesota Office of Environmental Assistance, has developed a system that reduces 90% of the time and energy required to heat treat cast aluminum components. This system, an in-line, fluidized bed technology, also reuses the process heat that is normally discharged, thus saving energy and reducing emissions.

Unlike existing technologies where components are stacked in baskets and placed in a convection or vacuum furnace, this process uses the fluidized bed in a continuous process mode. Because each component is individually heated in the fluidized bed, it resides in the bed only as long as necessary, thus reducing the process time from about eight hours to less than 30 minutes. Batch processing requires longer residence times to ensure that the inner surfaces and cores of the thicker components in the batch are properly heated.

Benefits

- Substantially increases energy efficiency, reduces energy use by 90%, and minimizes greenhouse gas emissions
- Eliminates problems of media dispersion into the facility and volatility in the heat chamber
- Reduces the rejection rate and increases consistency of quality and performance of product while lowering the amount/weight of aluminum needed to achieve performance standards
- Reduces the number of personnel required for loading, unloading, and transferring components
- Eliminates the disposal of sand contaminated with binders

Applications

Industries such as transportation (automotive engine blocks and heads, wheels, and other components) and computer components (notably disk drives) will benefit from reductions in process energy use, pollution, and component weight.

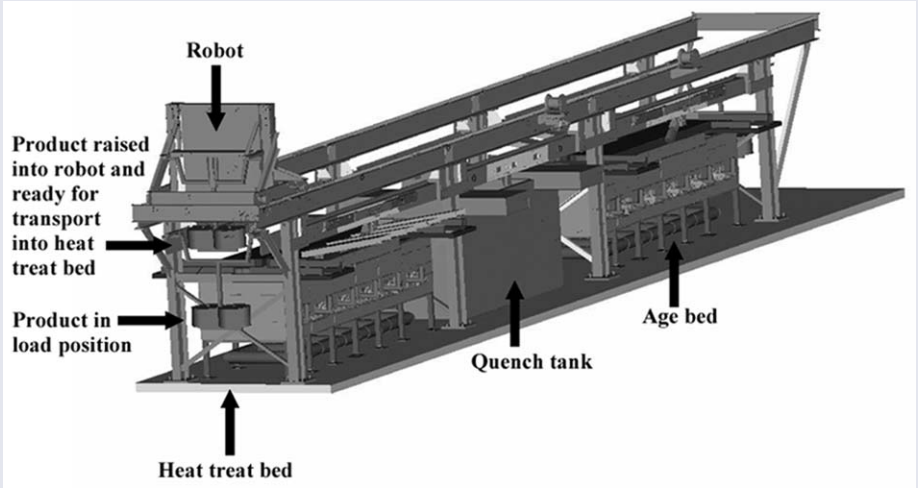
Project Partners

NICE³ Program
Washington, DC

Technomics, LLC
Plymouth, MN

The Minnesota Office of Environmental Assistance
St. Paul, MN

HEAT TREATING LINE



With the process developed by Technomics, double layered air tubes force air downward for fluidizing, keeping temperatures consistent throughout the treatment.

Additional benefits of this technology stem from the use of microprocessor-controlled pulse-fired burners. These burners allow for precise temperature control that reduces rejection rates and increases product consistency. Furthermore, precise and even temperature control improves component properties, thus enabling the design of lighter weight parts using less aluminum.

By the nature of the fluidized bed, this process also affords the ability to capture and reuse the casting sand that is traditionally disposed of. This sand can now be recycled in the fluidized bed and removed for use in new castings.

Project Description

Goal: Develop a full-scale operating unit so that aluminum foundries can test actual parts.

This technology uses a continuous-line aluminum heat treatment process rather than the traditional batch processing approach. This new process produces substantially lower cycle times. A high-speed automated line is used to retain the cast component's temperature through the fluidization heat-treatment process, thus reducing heating costs. The line is designed and built to the desired length for proper component passage. The fluidized bed is coupled to an automated production line used to insert, transport, and remove components from the heat treatment process. Pulse-fired microprocessor-controlled burners inject heat directly into submerged radiant burner tubes, ensuring precise, even, and rapid heat transfer.

In conjunction with this program, the Advanced Casting Research Center (ACRC) at Worcester Polytechnic Institute, under the direction of Professors Makhlouf and Apelian, has initiated a fundamental study to establish the transport phenomena relationships for heat treating of aluminum cast components.

Progress and Milestones

- Design is complete.
- Prototype tests have begun and are showing energy savings of greater than 90% compared to conventional heat treating.
- Evaluation of unit performance and integrity will follow necessary unit modifications to optimize the system.
- Once evaluated, coordination with aluminum foundries will take place to begin actual component testing.

NICE³ – National Industrial Competitiveness through Energy, Environment, and Economics:
An innovative, cost-sharing program to promote energy efficiency, clean production, and economic competitiveness in industry.
This grant program provides funding to state and industry partnerships for projects that demonstrate advances in energy efficiency and clean production technologies. Awardees receive a one-time grant of up to $525,000. Grants fund up to 50% of total project cost for up to 3 years.

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